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Parametric suppression of edge currents in Sr_2RuO_4 due to surface roughness[1] SRINIVAS RAGHU, SAMUEL LEDERER, Stanford University, WEN HUANG, EDWARD TAYLOR, CATHERINE KALLIN, McMaster University — The unconventional superconductor Sr_2RuO_4 is widely believed to have chiral p-wave symmetry, which requires spontaneous charge currents (of some magnitude) at sample edges. However, scanning magnetometry experiments[1], have set an upper bound on currents at least two orders of magnitude smaller than original theoretical predictions[2]. We propose that the currents are suppressed due to surface roughness, which quenches superconductivity within approximately a coherence length of the edge. The system can then be modeled as a normal metal in contact with a chiral p-wave superconductor. We justify this model with spectroscopic evidence from tunneling conductance[3], and calculate the edge current in the model. The current is suppressed by a factor on the order of Δ_0/E_F, which suffices to resolve the seeming contradiction between chiral p-wave pairing and undetectable edge currents.

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2. M. Matsumoto and M. Sigrist, J. Phys. Soc. Jpn. 68, 994 (1999).
3. S. Kashiwaya et al. Phys. Rev. Lett. 107, 077003 (2011).

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